

## A Revision of *Triuridaceae* of Japan

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*Triuridaceae* are represented by five species of *Sciaphila* in Japan: *S. multiflora* Giesen (new to Japan), *S. nana* Blume (= *S. japonica* Makino), *S. ramosa* Fukuy. & T. Suzuki (= *S. okabeana* Tuyama), *S. secundiflora* Benth. (= *S. tosaensis* Makino and *S. boninensis* Tuyama) and *S. tenella* Blume (= *S. takakumensis* Ohwi). Neotype of *S. tosaensis* is designated. *Sciaphila maculata* Miers in Malesia is regarded here as synonymous with *S. tenella*. The northernmost habitat of *Sciaphila nana* is in Miyagi Prefecture in northern Honshu at latitude about 38°24'N indicating also the northernmost limit of distribution of the genus as well as the family.

**Key words:** Japan, northernmost distribution, *Sciaphila*, taxonomy, *Triuridaceae*.

The first species of *Triuridaceae* discovered in Japan is *Sciaphila japonica* Makino from Mie Prefecture in central Honshu in 1902 (Makino 1902). Discovery of the species in Japan was a great contribution to the Japanese flora not only as an addition of a new family but also the first report of the family from temperate Asia. The second species, *S. tosaensis* Makino, was found in Kochi Prefecture in Shikoku in 1905 (Makino 1905). Further new species, *S. boninensis* Tuyama and *S. okabeana* Tuyama, were added by Tuyama (1936) from Ogasawara-shoto (= Bonin Islands) and *S. takakumensis* Ohwi was found in Mt. Takakuma-yama in Kagoshima Prefecture, southern Kyushu in 1938 (Ohwi 1938). All these species had been considered endemic to Japan.

Ohashi (2000a, 2000b) recognized *Sciaphila tosaensis* and *S. boninensis* as identical with *S. secundiflora* Thwaites ex Benth. that is distributed widely in Hong Kong, Thailand, Sri Lanka and Papuasia (Meerendonk 1984, Triboun and Larsen 1999). Also, Murata (2003) tentatively referred *S. japonica* and *S. okabeana* to *S. nana* Blume of SE Asia and *S. ramosa* Fukuy. & T. Suzuki of Taiwan, respectively. Accordingly, identity of the Japanese species needs a critical reexamination of whether they are distinct and endemic to Japan or identical with any known species described outside of Japan.

Recently, moreover, a specimen collected on Ishigaki-jima island in the Ryukyus was sent to Murata, one of the authors, in 2002 for identification. The material is referable to

*Sciaphila multiflora* Giesen and is a new addition to Japanese flora. Also we had a chance to examine fresh material of *S. okabeana* Tuyama that is a poorly known species collected from a large population of the species in Chichi-jima island in Ogasawara-shoto.

In the present paper all the species so far recorded from Japan and the new addition are reassessed on the basis of examination of living and/or herbarium materials.

### Taxonomic treatment

**Sciaphila** Blume, Bijdr. **10**: 514 (1826): Ohwi, Fl. Jap. 68 (1953); Kitam., Col. Illust. Herb. Pl. Jap. **3**: 389 (1964); Ohwi, Fl. Jap. ed. Engl. 130 (1965) & Fl. Jap. ed. rev. 81 (1965); Hatus., Fl. Ryukyus 654 (1971); Meerendonk in Fl. Males. ser. 1, **10**: 110 (1984); Mass-van de Kamer & Weustenfeld in Kubitzki, Fam. Gen. Vasc. Pl. **3**: 457 (1998).

*Andruris* Schltr. in Bot. Jahrb. **49**: 71 (1912); Walker, Fl. Okinawa 155 (1976); Yamashita in Satake & al., Wild Flow. Jap. Herb. Pl. **1**: 19 (1982); Mass-van de Kamer & Weustenfeld in Kubitzki, Fam. Gen. Vasc. Pl. **3**: 456 (1998).

*Parexuris* Nakai & F. Maek., Icon. Pl. As. Orient. **1**: 23 (Apr. 1936).

Nakai and Maekawa (1936) created *Parexuris* based on *Sciaphila tosaensis* as type and *S. japonica*. They considered the two species close to *Sciaphila* and *Hexuris* of South America, but differ from the former in having unilocular anther, three stamens and caudate perianth and from the latter in having unilocular anther and basal style. *Parexuris* has not been adopted by subsequent works and the species of the genus have usually been accommodated in *Sciaphila*.

*Sciaphila japonica* was recognized as a member of *Andruris* by Giesen (1938) and the name *A. japonica* (Makino) Giesen has been adopted by Walker (1976) in the Flora

of the Ryukyus and Yamashita (1982) and Tuyama (1989) in the Flora of Japan. *Andruris* is characterized in having male flowers with connective appendages of stamens (Giesen 1938, Mass-van de Kamer and Weustenfeld 1998), but the character is not related to any other characters to keep the genus as distinct from *Sciaphila*. We follow generic concept of Meerendonk (1984).

*Sciaphila* is distributed mainly in tropical and subtropical SE Asia with distribution centered on Malesia. Its approximate distribution boundary is illustrated by Meerendonk (1984), but the boundary of the genus as well as the family is further north. The northernmost locality of *Sciaphila nana* is a deciduous forest in Matsushima-machi, Miyagi Prefecture in northern Honshu, Japan (at latitude about 38°24'N and 141°4'E longitude), where the species was once collected in 1983 (Kumagami (1985) and the voucher specimen in TI). This species has been recorded in warm to temperate regions in Japan. This northernmost habitat of the species is also that of the generic as well as familial limit of distribution.

### Key to the species of *Sciaphila* in Japan

1. Style club-shaped with many papillae at apex; leaves and bracts ovate to broadly ovate ..... 2
1. Style subulate with glabrous apex; leaves and bracts ovate to narrowly ovate ..... 4
2. Flowers male and bisexual; perianth bearded at apex ..... *S. tenella*
2. Flowers unisexual ..... 3
3. Male flowers located between female flowers; perianth of male flowers with equal segments and bearded at apex ..... *S. multiflora*
3. Male flowers located on upper rachis above female lowers; Perianth of male flowers with 3 larger segments alternating with 3 smaller ones and all segments glabrous at apex ..... *S. secundiflora*
4. Inflorescences branched; perianth without

appendages at apex; filaments not exceeding anthers; style ca. 0.3 mm long

..... *S. ramosa*

4. Inflorescence simple; perianth dimorphic, 3 broader ones alternating with 3 narrower ones with a elliptic knob; filaments exceeding anthers; style 0.5–1 mm long

..... *S. nana*

1. ***Sciaphila multiflora*** Giesen in Engl., Pflanzenreich **104** (IV-18): 49, f. 10: 1–2 (1938); Meerendonk in Fl. Males. ser. 1, **10** (1): 120 (1984). [Figs. 1–2]

*S. mindanaensis* Giesen in Engl., Pflanzenreich **104** (IV-18): 51, f. 10: 3–6 (1938).

*S. stemmermanniae* Fosb. & Sachet in Pacif. Sci. **34**: 25, figs. 1–2 (1980).

Saprophytic herb; roots glabrous; stem filiform, purplish red, erect, 3–13 cm long, 0.3–0.8 mm in diameter, simple or seldom branched, without leaves, glabrous. Inflorescences racemose, 5–8 cm long, with 10–15 heteroclinous flowers, male flowers usually between female ones on rachis; pedicels 2–4 mm long, longer than flower, patent to recurved; bracts ovate, acute, 1–2 mm long, sessile. Male flowers (staminate flowers) ca. 1 mm across, with perianth-segments 6, 3 larger ones alternating with 3 smaller ones, all strongly reflexed, bearded at tip, larger segments narrowly ovate, acuminate, 0.8–1.3 mm long, ca. 0.4 mm wide at base, smaller ones 0.6–1 mm long, ca. 0.3 mm wide at base; stamens 3, receptacle plate-like, filament distinct, anthers yellow. Female flowers (pistillate flowers) ca. 1 mm across; perianth 6, similar to that of male flower but glabrous or bearded at tip; carpels densely 15–18; style club-shaped, attached above the middle on ventral side of carpel, ca. 0.8 mm long, exerted above, apex with papillae.

Japanese name: Ishigaki-sô (nov.).

Distribution: Japan: southern Ryukyus (Ishigaki-jima island); Philippines (Mindanao); New Guinea, and Micronesia (Palau).

Specimen examined: **Ryukyus**. Ishigaki-jima island. K. Miyahira, 2 Jul. 2002 (TI).

*Sciaphila multiflora* Giesen is recorded here for the first time from Japan. It is characteristic in having unisexual flowers, three larger perianth-segments alternating with three smaller ones in male flowers, a few beards at the tip, three stamens, 3-lobed anthers and shorter pedicels (cf. Meerendonk 1984).

This species was found in Ishigaki-jima island, southern Ryukyus. The habitat is isolated greatly from the nearest known localities in Mindanao island in the Philippines and Palau islands in Micronesia. The species looks similar to *Sciaphila tenella* (known as *S. takakumensis* in the Ryukyus) in having recurved pedicels 2–5 mm long and bearded perianth-segments, but quite different from it in having only unisexual flowers of which the male flowers are located between female flowers on the rachis. This feature in inflorescences is also described in *S. stemmermanniae* from Palau island, a species considered as identical with *S. multiflora* by Meerendonk (1984), that the male and female flowers are irregularly mixed on the rachis and one male flower is clearly illustrated below the female ones (Fosberg and Sachet 1980).

2. ***Sciaphila nana*** Blume, Mus. Bot. **1**: 322, f. 48 (1851); Giesen in Engl., Pflanzenreich **104** (IV-18): 18, f. 2: 4–10 (1938); Meerendonk in Fl. Males. ser. 1, **10** (1): 117 (1984); J. Murata in Red Data Pl. 536 (2003); Averyanov in Taiwaniana **52**: 15, fig. 2C & D (2007).

*Sciaphila japonica* Makino in Bot. Mag. (Tokyo) **16**: 211 (1902) [Type: Japan. Honshu. Mie Pref. (Prov. Ise), Hongo-mura (Hongo in Kusu-mura), Miye-gori. K. Teraoka, K. Imai & Y. Uyematsu, 7 Sep. 1902 (TI-holotype, Fig. 3; MAK-isotype)]; Ohwi, Fl. Jap. 68 (1953); F. Maek. & al., Makino's New Illust. Fl. Jap. 701 (1961);





Fig. 1. Natural habit of *Sciaphila multiflora* Giesen in Is. Ishigaki-jima, Okinawa Pref. Photo by K. Miyahira on 2 July 2002.

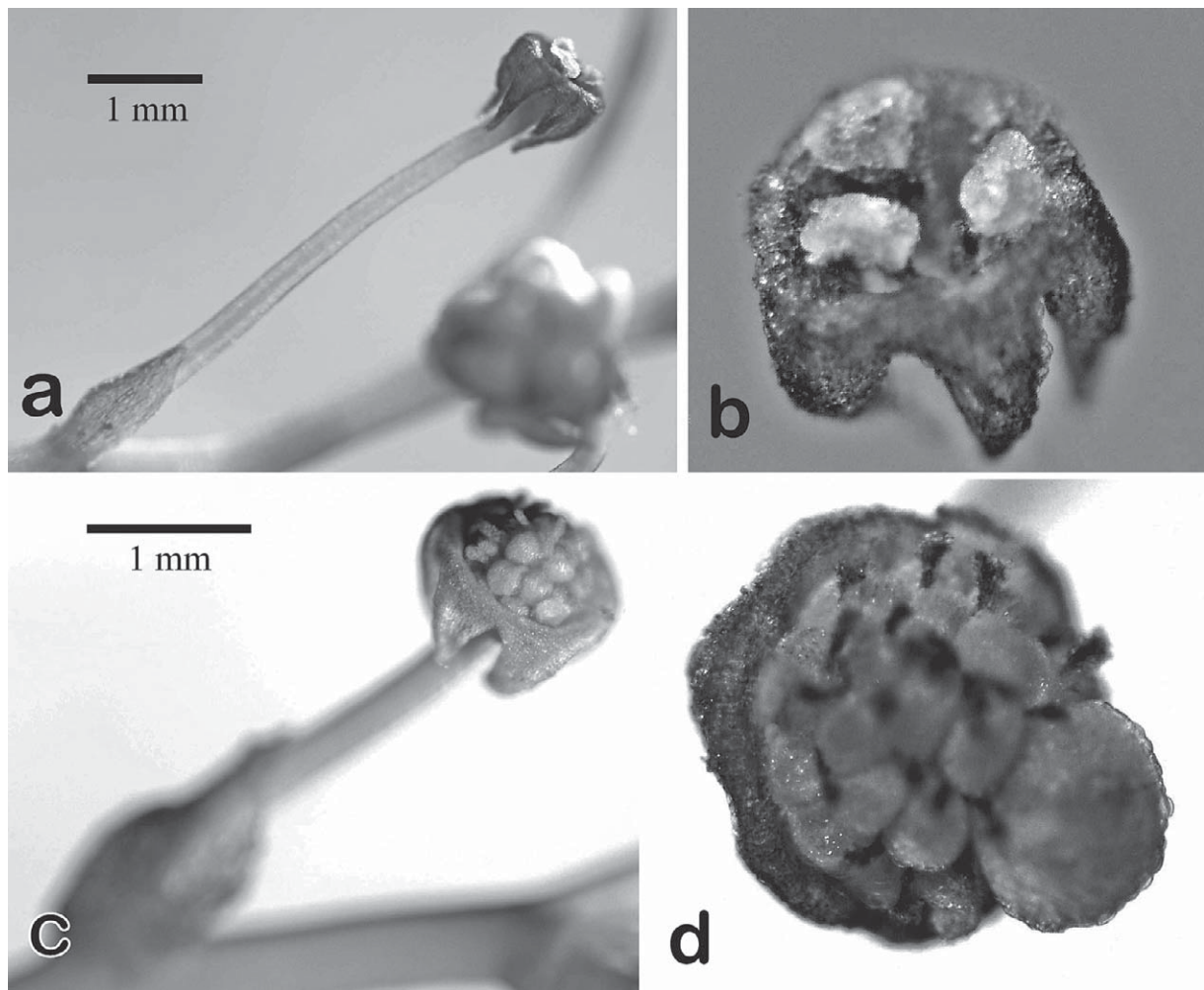


Fig. 2. Flowers of *Sciaphila multiflora* Giesen. Photo by J. Murata. a: Male flower with pedicel and bract. b: Upper view of male flower. c: Female flower, d: Upper view of female flower.

Kitam., Col. Illust. Herb. Pl. Jap. **3**: 389, pl. 104: 753 and fig. 235: 3–4 (1964); Ohwi, Fl. Jap. ed. Engl. 130 (1965) & Fl. Jap. ed. rev. 82 (1965); Hatus., Fl. Ryukyus 654 (1971); Ohwi & S. Kobayashi in Okuyama, Terasaki Illust. 872, fig. 3304 (1977); S. Kobayashi & M. Ono in Ogasawara Res. (13): 29 (1987); Shimab., Check List Vasc. Fl. Ryukyu. rev. ed. 602 (1997), syn. nov.

*Seychellaria japonica* (Makino) T. Ito in Bot. Mag. (Tokyo) **21**: 84 (1907).

*Parexuris japonica* (Makino) Nakai & F. Maek., Icon. Pl. As. Orient. **1**: 24 (1936), syn. nov.

*Andruris japonica* (Makino) Giesen in Engl., Pflanzenreich **104** (IV-18): 21 (1938);

Walker, Fl. Okinawa 155 (1976); Yamashita in Satale & al., Wild Flow. Jap. Herb. Pl. **1**: 19, pl. 10–5 (1982); Tuyama in Ono & al., Rev. Makino New Illust. Fl. Jap. 842, fig. 3365 (1989), syn. nov.

Japanese name: Hongôshô (Makino 1902).

Saprophytic herb, brownish to reddish purple; roots white, with a few filiform lateral roots. Stems appearing usually from July to October, erect, 3–13 cm long, filiform, 0.3–0.8 mm in diameter, often branched, with few appressed scaly leaves; leaves narrowly ovate, ca. 1.5 mm long. Inflorescences terminal, with unisexual flowers, 1–5 cm long; racemes loosely 4–15-flowered, with male flowers on upper part; pedicels 2–7 mm



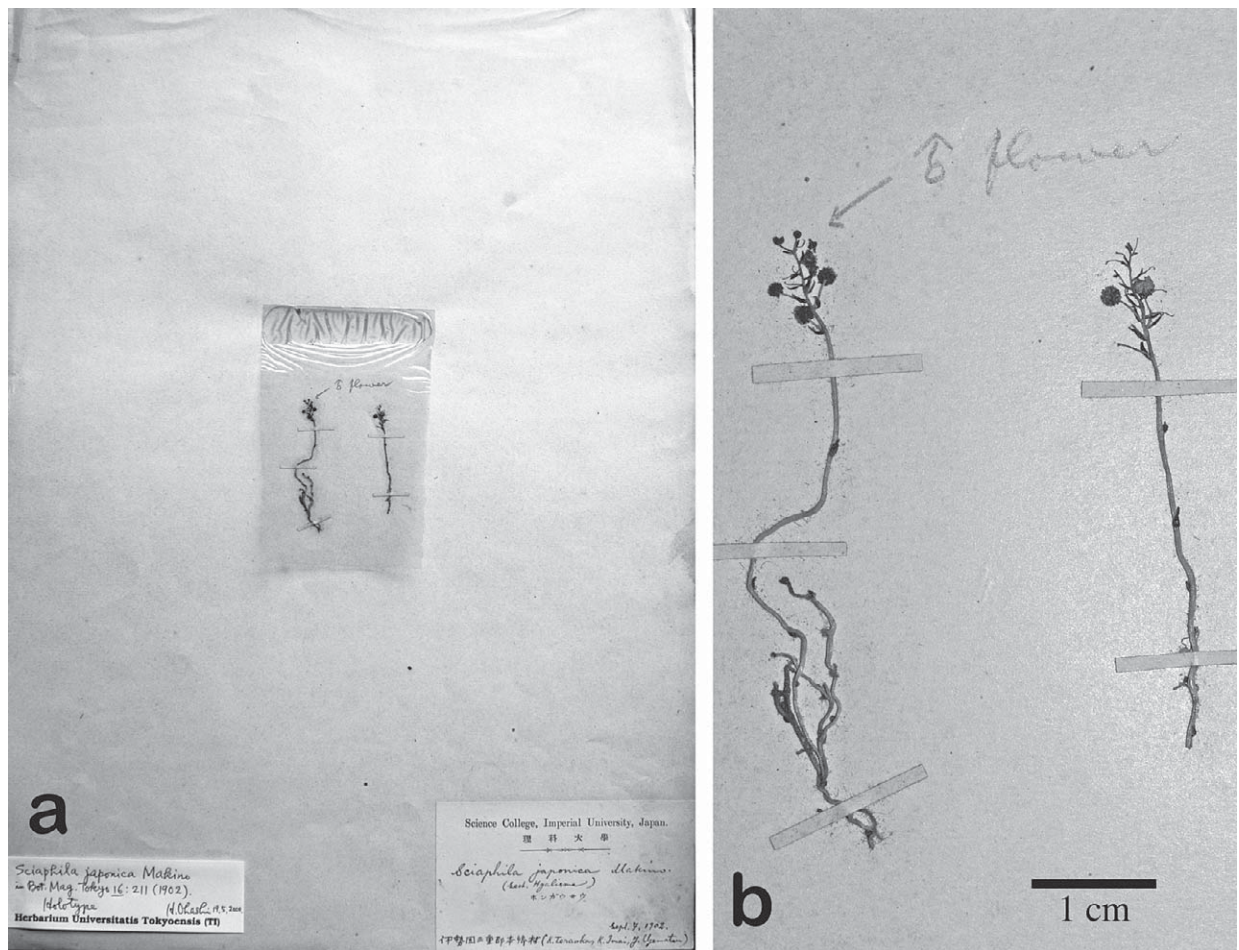


Fig. 3. Holotype of *Sciaphila japonica* Makino (TI). a: Specimen with the label written by Makino at the lower right-hand. b: Enlarged the specimen with handwriting indicating male flower by unknown person.

long, longer than flower; bracts minute, linear or narrowly ovate, acuminate. Male flowers ca. 2 mm across, with 3 reduced carpels; perianth usually 6, connate at base, segments narrowly ovate, glabrous, 3 slightly broader than alternating 3, acuminate, narrower 3 with a globose knob at apex; stamens 3, anthers sessile, filament-connective extended into a minute cylindrical appendage. Female flowers ca. 2 mm across; perianth usually 6, ovate, acute; carpels numerous, ca. 0.7 mm long, globose at apex; style attached above the middle on ventral side of carpel, subulate, acuminate, ca. 0.8 mm long, exerted above. Fruits globose, ca. 2 mm across, with shrivelled style near base.

Distribution: Japan: Honshu (Miyagi,

Niigata, Tochigi, Chiba, Kanagawa and westward), Shikoku, Kyushu, and Ryukyus (Okinawa island); Vietnam, Thailand, Philippines (Luzon), Malaya, Sumatra, and Java.

Specimens examined: Japan. Honshu. **Miyagi** Pref.: Matsushima-machi, Nemawashi, Ichinowatashi. 4 Sep. 1983. H. Kumagami (TI). **Aichi** Pref. Shinshiro-cho, Sakurabuchi. 30 Sep. 1956. G. Murata (KYO); Nagasawa-mura. 6 Sep. 1953. K. Torii (KYO); near Ichinomiya. I. Yamamoto (TI); Niwa-gun, Akitsumura. T. Mori (TI). **Mie** Pref. Hongo-mura (TI-holotype of *Sciaphila japonica* Makino; MAK-isotype); Ise, Isejingu. T. Ito (KYO); loc. cit. 26 Aug. 1926. Y. Araki (KYO). **Wakayama** Pref. Mt. Nachi-san, Ichinotaki. 26 Jul. 1897. K. Minakata (TI); Mt. Nachi-san. 26 Sep. 1904. K. Minakata (TI); Iwata-mura. 1 Sep. 1933. K. Sato (TI); Iwata-mura, Oka. 20 Aug. 1928. S. Kitajima (KYO, TI); Kamitonda-machi, Oka. 11 Aug. 1929. N. Ui (TUS); loc. cit. 23 Sep. 1959. M.

Kashi-yama (TUS). **Hyogo** Pref. Mt. Hunakosi. 9 Oct. 1954. K. Utumi (KYO); Mihara-machi. Umamawari, 200–400 m. 29 Jul. 1995. T. Kobayashi 27549 (KYO); loc. cit., ca. 100 m. a grove of bamboos. 20 Aug. 1993. H. Kato, N. Fukuoka, N. Kurosake & S. Miyake 930893 (KYO); Mt. Kashiwabara-yama. 3 Sep. 1910. J. Hirano (TI). **Yamaguchi** Pref. Ootanibuchi in Chomon-kyo. 18 Oct. 1972. Y. Takeuchi (TUS).

Shikoku. **Tokushima** Pref. Awa, Suzuga-mine near Shishikui-cho, Kaihu-gun. 1 Nov. 1951. S. Kitamura & G. Nakai (KYO); loc. cit., alt. 350. 11 Nov. 1978. T. Yamazaki (TI).

Kyushu. **Kumamoto** Pref., Mt. Kinpo-san. 29 Jul. 1906. M. Yamazaki (KYO), H. Kozuma (MAK 9258), 3 Aug. 1905. H. Kozuma (MAK 256575), 20 Sep. 1905. H. Kozuma (KYO), Aug. 1907. K. Miyake (MAK 24937), 3 Sept. 1907. H. Kozuma (MAK 9257) Aug. 1909. M. Kaneko (MAK 24938). **Kagoshima** Pref., Hioki-mura. 6 Jan. (probably mistake for Jul.) 1914. Z. Tashiro (MAK 24940), Is. Yakushima. 21 Jul. 1928. G. Masamune (TI); loc. cit. Kurio. 5 Aug. 1935. Y. Doi (TI); loc. cit. Miyanoura-gawa, alt. 200 m. 27 Aug. 1960. T. Yamazaki (TI).

Ryukyus. **Okinawa** Pref. Is. **Okinawa**. Kunigami-son, Yona. in the University of Ryukyu Experimental Forest. Jul. 1972, fl. T. Sinzato (RYU); Nakama. 25 Jun. 1967, fl. Y. Miyagi 3390 (RYU); Mt. Yonahadake. fl. Y. Niiru s.n. (RYU). Nago-shi. Mt. Nago-dake. 10 Jul. 1951, fl. T. Amano 6591 (RYU); loc. cit. 10 Jul. 1978, fl. K. Kakazu 121 (RYU); near summit of Mt. Nago-dake. 6 Aug. 1938. T. Kanashiro 747 (RYU); Mt. Taniyu. 13 Jul. 1951, fl. T. Amano 6605 (RYU); Mt. Meiji-dake. 17 Oct. 1973. E. Nakata (RYU); Kadena-cho. 19 Jun. 1938. S. Tawada 825 (KYO); Yomitan-son, Mt. Yomitan-dake. 25 Jul. 1936. Y. Taira 117 (KYO); Mt. Yonahadake. Y. Nozu 9 Nov. 1957 (TI); Mt. Awa-dake, alt. 300 m. 24 June 1955. S. Hatusima 18311 (TI). Is. **Ishigaki-jima**. Mt. Omoto-dake. Aug. 1936. S. Sacaguchi (MAK 9253 only right-hand specimen, excl. left-hand specimen that is *S. secundiflora*). Is. **Iriomote-jima**, in primary forest of Mt. Goza-dake, alt. 300 m. 16 Jul 1955. S. Hatusima 18775 (TI).

*Sciaphila japonica* Makino has long been recognized as one of the remarkable representative plants endemic to Japan. However, Makino (1902) recognized the species as resembling *S. nana* Blume in the original description. He showed no diagnostic features of his new species from the latter. We could not find differences between them and consider that both are identical.

*Sciaphila japonica* Makino was described on the basis of a specimen collected by K. Teraoka, K. Imai & Y. Uyematsu at Hongo in Ise province from which the Japanese name of the species Hongôsô was taken on 7 September 1902. There are, however, two herbarium sheets in MAK and TI, respectively and each of them were kept as holotype of the species. Both specimens agree with the original description in morphology. The TI specimen is shown in Fig. 4 and the MAK specimen is seen online Makino Herbarium Type Specimen Image Database ([http://taxa.soken.ac.jp/MakinoDB/makino/html\\_j/index.html](http://taxa.soken.ac.jp/MakinoDB/makino/html_j/index.html)). The TI specimen bears a complete label of the specimen with the Latin name, Japanese name, locality in Japanese, date of collection and collectors written by Makino himself, while the MAK specimen lacks a label prepared by Makino and has only a Japanese name (in Chinese characters, not the Japanese name from the label of TI specimen) and Province (not exact locality of the specimen, only the name of Ise Province in Chinese characters) written by Makino on a newspaper that enveloped the specimen. The original collectors names of the specimen in Chinese characters are written on a small piece of paper on the MAK specimen. These facts indicate that Makino (1902) used the TI specimen for the publication of *Sciaphila japonica* Makino, and the MAK specimen is a duplicate of the TI specimen. We recognize here the TI specimen as holotype and the MAK one is isotype.

3. **Sciaphyla ramosa** Fukuy. & T. Suzuki in J. Jpn. Bot. **12**: 414, figs. 3 & 4 (June 1936) [Type. Taiwan. Ins. Kotosyo, in pluviisilvis monte Omori-yama, c. 300 m. alt. 3 Jul. 1934. N. Fukuyama 3617 (TAI)]; Giesen, Pfl.-reich **104** (IV-18): 70 (1938); L. Y. Zhou & X. W. Zhong in X. Z. Sun, Fl. Reipub. Popul. Sin. **8**: 193 (1992); H. Ohashi in Fl. Taiwan ed. 2, **5**: 1088 (2000); J.



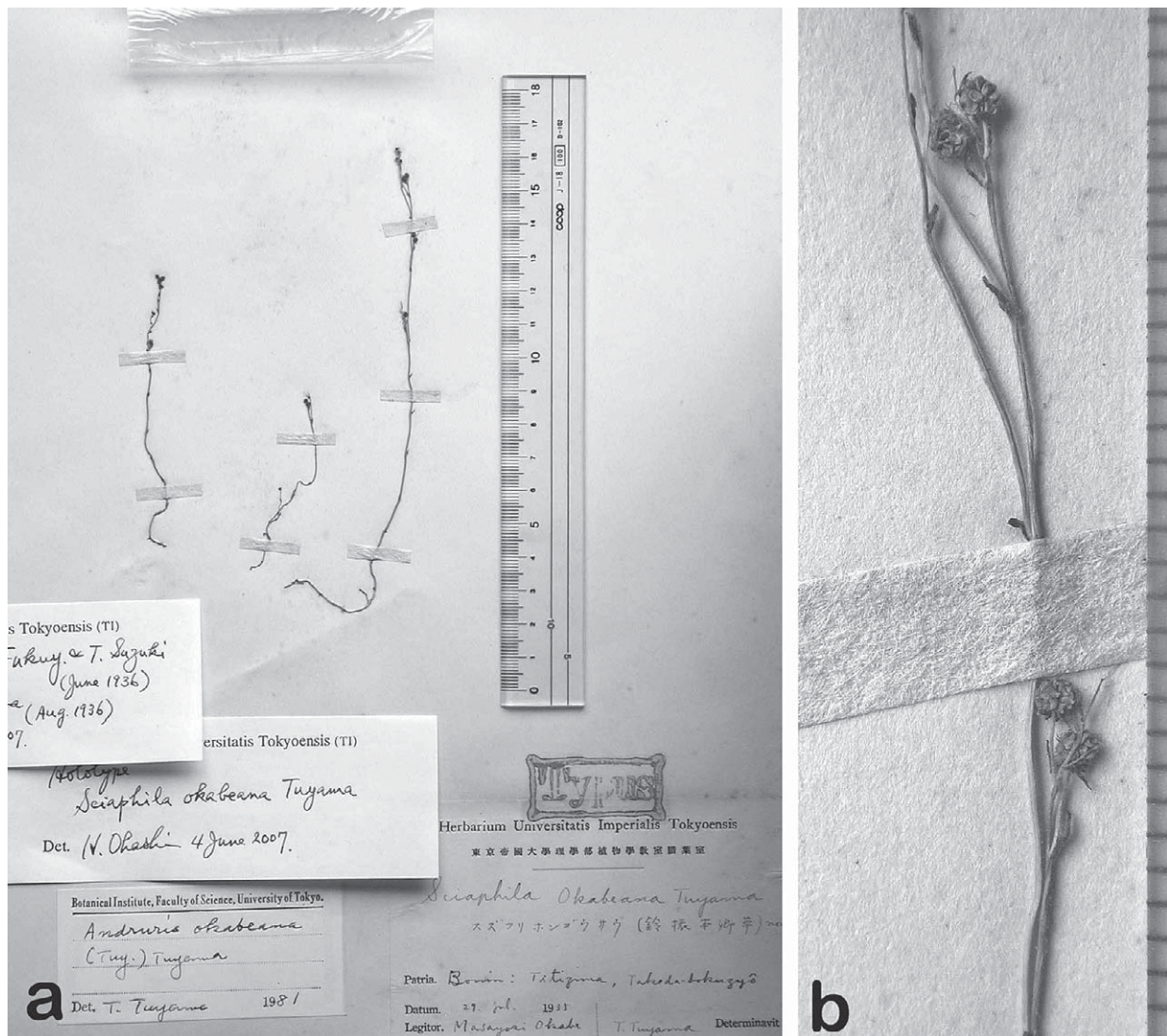


Fig. 4. a: Holotype of *Sciaphila okabeana* Tuyama (TI). b: Enlarged inflorescences showing small female flowers.

Murata, Red Data Pl. 527 (2003); T. H. Hsieh & al. in *Taiwania* **48**: 244, f. 1 E–F, f. 2 C (2003).

*S. okabeana* Tuyama in *Bot. Mag. (Tokyo)* **50**: 426 (August 1936) [Type: Bonin. Chichi-jima island. Takeda-bokujo. 29 Jul. 1935. M. Okabe (TI-holotype; Fig. 4)]; Ohwi & Kobayashi in *Okuyama, Terasaki Illust.*: 872, fig. 3305 in part, excl. one left-hand plant with enlarged flowers (1977); Yamashita in *Satake & al., Wild Flow. Jap.* **1**: 20 (1982).

Japanese name: Suzufuri-hongôshô

(Tuyama 1936).

Erect herb, purplish red to purplish brown. Stem simple or branched above middle, 3–10 cm high, 0.2–0.5 mm in diameter. Leaves narrowly ovate, 1–2 mm long. Inflorescences raceme-like paniculate with 1–2 branches or simply racemose, 7–30 mm long, each raceme usually with 2–3 male flowers on upper part and 3 female ones on lower part, protandrous, raceme-axis 5–12 mm long. Bracts ca. 0.4 mm long, narrowly ovate, apex long-acute. Pedicel 0.6–1.0 mm long. Male flowers ca. 1.5 mm across, perianth



5–6, connate at base, segments equal in shape and size, reflexed, ovate-oblong, apex long acute to acuminate, 0.5–0.8 mm long, 0.2–0.3 mm wide. Stamens 3, filament-connective not extended; filaments sessile. Female flowers 1.2–1.5 mm across; perianth 5–6, segments ovate, 0.5–0.7 mm long, ca. 0.3 mm wide, apex acute, reflexed, equal in shape and size. Carpels ca. 30 per one inflorescence; style ca. 0.3 mm long, awl-shaped. Infructescence ca. 2 mm in diameter.

Distribution: Japan (Bonin Islands: Chichi-jima and Ani-jima islands) and Taiwan (Kô tô sho = Lanyu).

Specimens examined. Japan. Tokyo Pref., **Ogasawara-shoto**. Chichi-jima island, Takeda-bokujo. 29 Jul. 1935. M. Okabe (TI–holotype, isotype); loc. cit. 3 Aug. 1935. I. Kurita (TI); loc. cit. 16 Nov. 1935. T. Tuyama & M. Okabe (TI); loc. cit. 24 June 1940. T. Tuyama (TI); loc. cit. 29 May 1983. T. Yasui-C (TI); along the Hatsuneyama Yuhodo. On rocky slope. 22 Jul. 1975. G. Murata, H. Tabata, K. Tsuchiya & K. Takada 116 (KYO); Mt. Hatsune-yama. 16. Jun. 1979. S. Kobayashi & Y. Ohmori (MAK 184224); Higashidaira, alt. 220 m. 1 Jul. 2000. H. Kato 000089 (MAK 309623); loc. cit. 5 Jul. 2002. H. Kato (TUS). Ani-jima island, near Mt. Kitafutago-yama. 12 June 1983. T. Yasui-B (TI).

*Sciaphila ramosa* was described from a single individual, but recently Hsieh et al. (2003) rediscovered the plants at the type locality and made a careful description of the species. Fukuyama and Suzuki (1936) described and illustrated (fig. 4 in their paper) the perianth segments of the species as almost equal with apiculate or slightly acute apex, but, according to Hsieh et al. (2003), those of male flowers have three larger alternating with three smaller segments each with a stipulate globose knob at apex, although the segments are illustrated as equal by them (cf. Fig. 2 C in Hsieh et al. 2003), and those of female flowers are similar to that described by Fukuyama and T. Suzuki. We examined perianth-segments of male and female flowers of *S. okabeana* from Chichi-jima preserved in alcohol and confirmed them as equal in shape and size

and without a knob at apex. At the same time, however, we noted that the apex of segments often shrinks in somewhat older flowers and the shrunken part is similar to a knob in the material. Other characters of *S. okabeana* agree to *S. ramosa*. We consider, therefore, both species are identical.

*Sciaphila ramosa* is distinctly smaller than other Japanese species of the genus. It grows sympatric with *S. secundiflora*, but both are easily separable even by thickness of the stem, i.e., less than 0.5 mm in diameter in the former, while 0.5–1.5 mm in diameter in the latter. Also, leaves (usually ca. 1 mm long, at most ca. 2 mm long), bracts, and female flowers (less than 2 mm in diameter) are characteristically minute, but the inflorescence is usually branched, although simple in the other species. It is usually with 1–2 branches. The branch is a minute raceme usually with 2–3 male flowers on the upper part and 3 female ones on the lower part, and the flowers are protandrous in each raceme.

4. *Sciaphila secundiflora* Thwaites ex Benth. in Hook. J. Bot. Kew Misc. 7: 10 (1855) [Type: Ceylon. Thwaites (K–holotype)]; Giesen, Pflanzanreich 104 (IV-18): 60, f. 14; 1–3 (1938); Meerendonk in Fl. Males. Ser. I, 10: 116 (1984); H. Ohashi in Taiwaniana 45: 352 (2000), & Fl. Taiwan ed. 2, 5: 1087 (2000); T. H. Hsieh & al. in Taiwaniana 48: 245, f. 1 G–H, f. 2 D (2003); J. Murata in Red Data Pl. 526 (2003).

*Sciaphila tosaensis* Makino in Bot. Mag. (Tokyo) 19: 140 (1905) [Type: Japan. Shikoku. Kochi Pref. (Prov. Tosa). Y. Tokihisa s.n. Jul. 1906 (MAK–neotype designated here; Fig. 5)]; Makino & Nemoto, Fl. Jap. Suppl. 1294 (1931); Giesen in Engl., Pflanzanreich 104 (IV-18): 68 (1938); Ohwi, Fl. Jap.: 68 (1953); Masam. in Sci. Rep. Kanazawa Univ. 4: 209 (1956); F. Maek. & al., Makino New Illust. Fl. Jap. 702 (1961); Kitam., Col. Illust. Herb. Pl. Jap. 3: 389, pl. 104: 754, fig. 235 1–2 (1964); Ohwi, Fl. Jap.

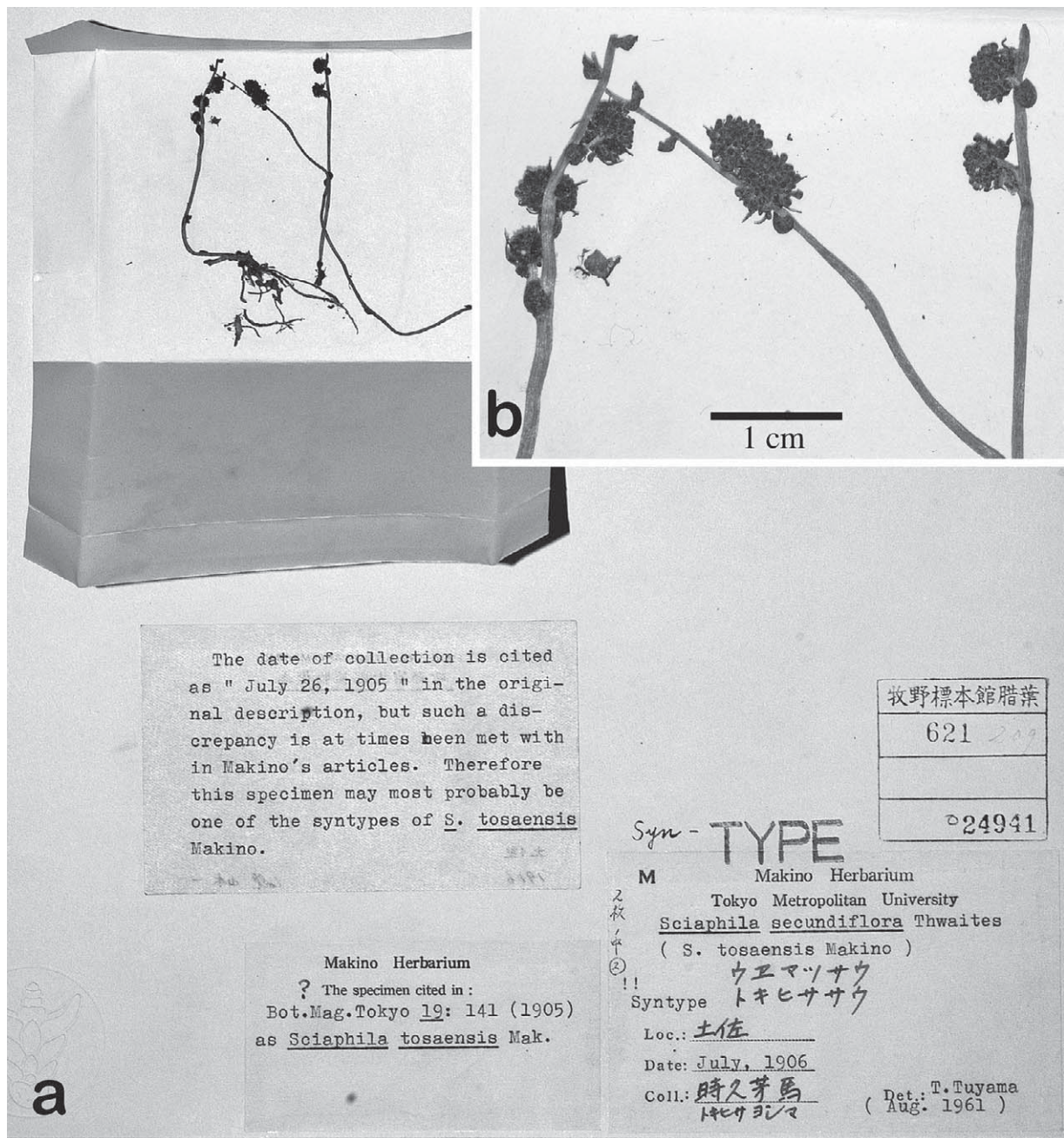


Fig. 5. a: Neotype of *Sciaphila tosaensis* Makino (MAK). b: Enlarged inflorescences.

ed. Engl.: 131 (1965) & Fl. Jap. ed. rev. 82 (1965); Hatus., Fl. Ryukyu 655 (1971); Walker, Fl. Okinawa 156 (1976); Yamashita in Satake & al., Jap. Herb. Pl. 1: 19, pl. 10 (1982); Tuyama in Ono & al., Rev. Makino's New Illust. Fl. Jap. 842, fig. 3366 (1989); Ohwi & Kitag., New Fl. Jap. Rev. 92 (1992); Shimab., Check List Vasc. Fl. Ryukyu rev. ed.: 602 (1997).

*Seychellaria tosaensis* (Makino) T. Ito in Bot. Mag. (Tokyo) 21: 85 (1907).

*Parexuris tosaensis* (Makino) Nakai & F. Maek., Icon. Pl. As. Orient. 1: 23, tab. 11 (Apr. 1936).

*Sciaphila megastyla* Fukuy. & T. Suzuki in J. Jap. Bot. 12: 412, figs. 1 & 2 (June 1936) [Type: Taiwan. Lanyu Island (Ins. Kotosho); in pluviisilvis monte Omori-yama,



c. 300 m. alt. 23 May 1935. Suzuki 3616 (TAI-holotype, not found)]; Giesen in *Pflanzenreich* **104** (IV-18): 69 (1938); L. Y. Zhou & X. W. Zhong in *Fl. Reip. Popul. Sin.* **8**: 191 (1992).

*Sciaphila boninensis* Tuyama in *Bot. Mag.* (Tokyo) **50**: 425, fig. 33 (Aug. 1936) [Type: Japan. Bonin. Chichijima (as Titizima) island, Takeda-bokujo. M. Okabe s.n. 29 Jul. 1935 (TI-holotype.)]; Giesen, *Pflanzenreich* **104** (IV-18): 68 (1938); Ohwi & Kobayashi in Okuyama, Terasaki *Illust.*: 872, figs. 3305 pro parte, incl. left-hand plant with flowers.

*Sciaphila okabeana* auct. non Tuyama: Ohwi & Kobayashi in Okuyama, Terasaki *Illust.*: 873, fig. 3306 (1977); Toyoda, *Fl. Boin*: 211 & 213 (1981).

Japanese name: Uematsusô (Makino 1905).

Saprophytic herb with white, pink or brownish to reddish purple terrestrial organs; roots with filiform lateral branches. Stems appearing usually from July to September, simple, sometimes branched at base, erect, 6–20 cm long, 0.5–1.5 mm in diameter, with a few alternate scaly leaves. Leaves ovate or narrowly ovate, acuminate, 2–4 mm long. Inflorescences terminal racemose, erect, with 3–22(–35) flowers, male flowers towards apex, female flowers towards base; bracts narrowly ovate, scale-like, 1–4 mm long; pedicels 1–5 mm long. Male flowers 6–7 mm across; perianth 4–8, usually 6, connate at base, equal, narrow- to linear-triangular, 2–5 mm long, 0.2–0.5 mm wide, apex glabrous, without appendages; stamens usually 3, subsessile; female flowers ca. 5 mm across; perianth 4–10, segments equal, apex glabrous; pistils 10–80, free; ovary obovate, 0.5–1 mm long, apex rounded, densely globose papillate; style clavate, inserted laterally at base, exceeding ovary; stigma with dense cylindrical papillae. Fruits achene, ca. 4 mm across, each obovoid, longitudinally lined, apex densely minute processes. Seeds 1, ellipsoidal, ca. 0.7 mm long, surface re-

ticulate.

Distribution: Japan, Honshu (Niigata, Tokyo, Shizuoka, Mie, Wakayama, Kyoto, Hyogo, and Hiroshima Prefectures), Shikoku, Kyushu and the Ryukyus (Okinawa and Iriomote-jima islands); Taiwan (Kueishan and Lanyu islands); Hong Kong; Thailand; Papuaasia; and Sri Lanka.

Specimens examined: Japan. Honshu. **Niigata** Pref., Nishikubiki-gun, Ichiburi-mura. S. Kunori. Sep. 1934 (TI). loc. cit. 24 Sep. 1935. R. Koto (KYO). **Tokyo** Pref., Izu Is. Mikura-jima island. 26 Jul. 1962. Satomi 20205 (TUS); Hachijo-jima island. 21 Jul. 1950. H. Murakawa (TI), loc. cit., Mt. Mihara-yama. 29 Aug. 1976. M. Ishii (TI); Ogasawara-shoto. Chichijima (as Titizima) island, Takeda-bokujo. 29 Jul. 1935. M. Okabe s. n. (TI-holotype of *Sciaphila boninensis* Tuyama); loc. cit. 16 Nov. 1935. Tuyama & Okabe (TI); loc. cit. 24 June 1940. T. Tuyama (TI); Higashidaira, alt. 220 m. 1 Jul. 2000. H. Kato 000088 (MAK 309622); loc. cit. 5 Jul. 2002. H. Kato (TUS). Muko-jima island. 14 Jul 1937. M. Okabe (TI), 8. Jul. anno? S. Kobayashi (MAK 257618). Ane-jima island. 17 Jul 1937. M. Okabe (TI). Haha-jima island, Mt. Funaki-yama. 19 Jul 1937. M. Okabe (TI); loc. cit. 24. Jun. 1979. S. Kobayashi & Y. Ohmori (MAK 180728). **Wakayama** Pref. Kamitonda-cho, Iwata. 22 Aug. 1915. N. Ui (KYO), Iwata-mura, Okagawa. Aug. 1921. Nakajima (TI), loc. cit. 30 Aug. 1932. Nakajima (TI); Iwata-mura. 17 Aug. 1929. N. Ui (TI); loc. cit. 27 Aug. 1931. N. Ui (TUS), loc. cit. 31 Aug. 1933. N. Ui (TUS); loc. cit. 6 Aug. 1925. T. Ito (TUS); Kamitonda-cho, Okagawa. Aug. 1921. Kitajima (KYO); loc. cit. 20 Aug. 1921. K. Kashiya (TUS); loc. cit. 15 Aug. 1958. S. Sugaya (TUS); Usiya-dani, Syogawa, Kitatinda-mura. 16 Aug. 1954. M. Tagawa 6254 (KYO). **Kyoto** Pref., Fukuzumi-mura. 23 Jul. 1939. S. Higuchi (KYO); Tamba, Ooe-machi, Motoisenaigû, Mt. Iwato-yama. 1 Sep. 1929. Y. Araki (KYO). **Hyogo** Pref., Taki-gun, Hukuzumi-mura. 23 Jul. 1941. H. Higuchi (KYO); Mikawa-mura, Mt. Hunakosi. 30 Aug. 1954. K. Utumi (KYO); Kobe-shi, Nishi-ku, Oshibedani-machi, Kizugawa-ike, alt. 150–250 m. 28 Aug. 1999. T. Kobayashi 33663 (KYO); Taka-gun, Hinobesho-mura. Aug. 1928. Z. Tashiro (KYO).

Shikoku. **Tokushima** Pref., Kainan-shi, Kainan-cho, Todorokino-taki. 15 Aug. 1961. H. Koyama 1188 (KYO). **Kochi** Pref., unknown. anno 1906. H. Yamamoto (MAK 24943); Kami-gun, Yasu-mura, Kamiyasu, Mt. Chigaidô-yama. 21 Jul. 1908 Z. Tashiro? (KYO, MAK 9254); loc. cit. 11 Aug. 1909. M. Ogawa (MAK 24944); Muroto-misaki, 23 Jul.

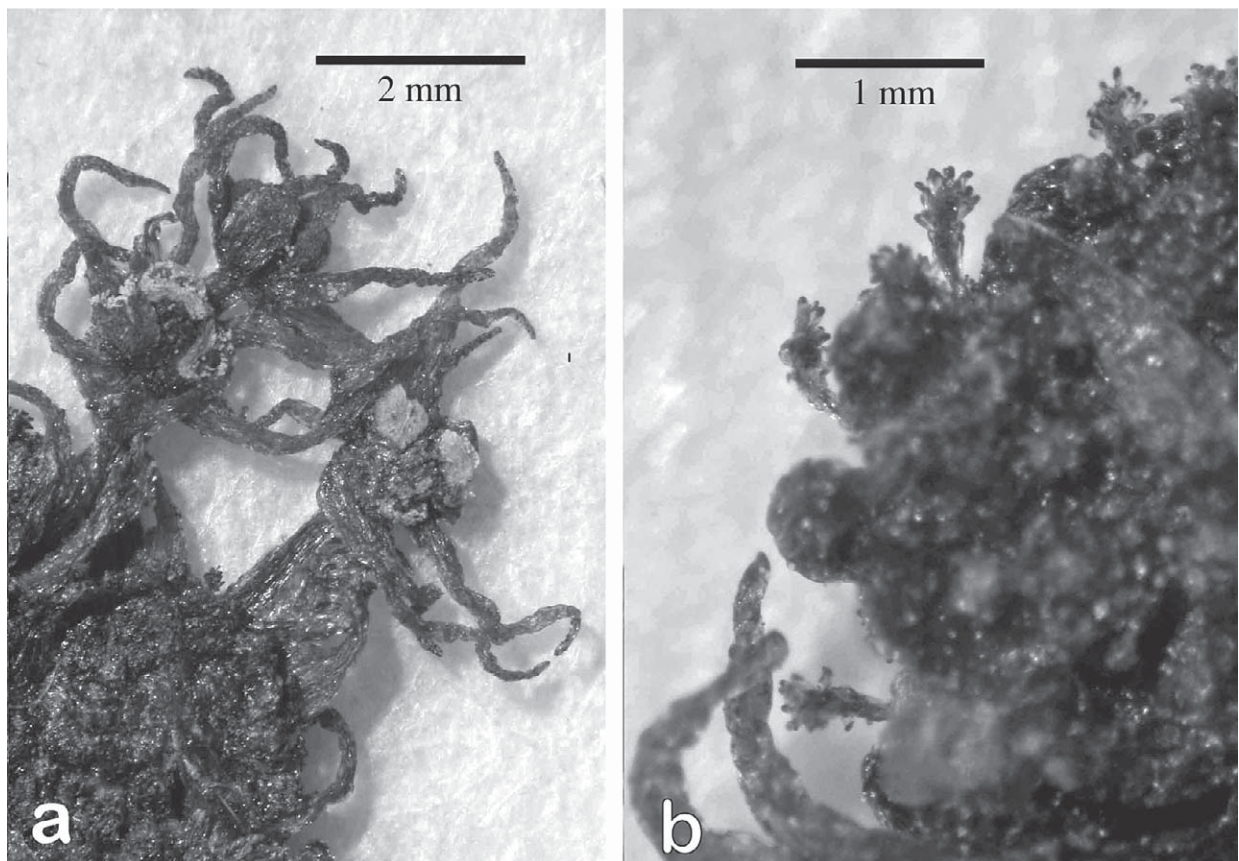


Fig. 6. a: Male flowers of *Sciaphila secundiflora* Thwaites ex Benth. b: Female flowers of *S. secundiflora* Thwaites ex Benth. showing clavate styles with dense cylindrical papillate stigmas. Material collected in Iriomote-jima island by S. Kobayashi in 2006.

1959. I. Tomonaga (KYO). **Ehime** Pref. Shûsô-gun, Sakuragi-mura, Kiritani. 28 Jul. 1940. I. Yogo (KYO).

Kyushu. **Nagasaki** Pref. Fukue-jima island, Tamanoura-mura, Arakawa. 18 Aug. 1906. Z. Tashiro (MAK 24945); Tsushima island. Mt. Tatsura-san. 22 Aug. 1988. S. Watanabe (KYO); Gotô-jima island, Arakawa, Nanafushigishita. 18 Aug. 1906. Z. Tashiro (KYO). **Kagoshima** Pref. Kagoshima-shi (?), Shingakuji. Aug. 1910. Unknown collector (MAK 256576); Yakushima island. 6 Aug. 1936. Z. Tashiro (KYO); loc. cit. 5 Aug. 1935. Y. Doi (TI).

**Okinawa** Pref. Okinawa island. Kadena-cho. 19 Jun. 1938, fl. & fr. S. Tawada 824 (KYO); Okinawa-shi, (Goeku-mura), Mt. Gotenshiki-yama. Mar. 1938, fl. Y. Taira 532 (RYU); loc. cit. 11 Apr. 1938, fl. Y. Taira 225 (KYO). Nago-shi. Mt. Nago-dake. 10 Jul. 1978, fl. Kakazu 122 (RYU). Iriomote-jima island. Valley of Urauchi-gawa River. 17 Apr. 1998, fl. Yonekura & al. 98118 (TUS); loc. cit. 19 Apr. 1998, fl. Yonekura & al. 98212 (TUS). Kunigami, Mt. Awa. 24 June 1955. S. Hatusima 18310 (TI). Ishigaki-jima

island, Mt. Omoto-dake. Aug. 1935. S. Sakaguchi (MAK 9253 left-hand specimen).

Makino (1905) cited two specimens with the original description of *Sciaphila tosaensis* as “Hab. Prov. Tosa: Chigaidô-yama in Kami-yasu, Yasu-mura, Kami-gôri (Yoshima Tokihisa! July 26, 1905; Yeijirô Uyematsu! Sept. 10, 1905”. Unfortunately the specimens were not found in TI and MAK. One specimen collected by Tokihisa in Prov. Tosa in July 1906 is kept in MAK as MAK24941 (Fig. 6), but the locality and date of collection does not agree with those of the syntype. The specimen was suggested by Tuyama in 1961 as one of the syntypes of *S. tosaensis* Makino on the specimen because of a probable erroneous record by Makino. We, however, regard the specimen



as not one of the syntypes, because it lacks the detailed collection site and date indicated in the original description. We select the specimen here as the neotype of *S. tosaensis* Makino.

The northernmost locality of *Sciaphila secundiflora* is in Niigata Prefecture which is a relatively temperate region as for *S. nana*.

**5. *Sciaphila tenella*** Blume, Bijdr. **10**: 515 (1826); Meerendonk in Fl. Malesiana **10**: 113 (1984); L. Y. Zhou & X. W. Zhong in Fl. Reipubl. Popul. Sin. **8**: 191, tab. 75 (1992).

*S. maculata* Miers, Proc. Linn. Soc. **2**: 73 (1850) & in Trans. Linn. Soc. **21**: 48 (1852); Meerendonk in Fl. Malesiana **10**: 113 (1984); T. H. Hsieh & al. in Taiwaniana **48**: 244 (2003), syn. nov.

*S. takakumensis* Ohwi in Acta Phytot. Geobot. **7**: 133 (1938) [Type: Kagoshima, Takakuma-mura. K. Hori, (KYO)] and Fl. Jap. **68** (1953); Kitam., Col. Illust. Herb. Pl. Jap. **3**: 389, fig. 235: 5 (1964); Ohwi, Fl. Jap. ed. Engl. **130** (1965) & Fl. Jap. ed. rev. **81** (1965); Hatus., Fl. Ryukyus **654** (1971); Walker, Fl. Okinawa **155** (1976); Yamashita in Satake & al., Wild Flow. Jap. **1**: 20 (1982); Shimab., Check List Vasc. Fl. Ryukyu ed. rev. **602** (1997); Hatus., Fl. Kyushu **234** (2004), syn. nov.

Japanese name: Takakumasô (Ohwi 1938).

Reddish purple or dark purplish red saprophytic herb; roots filiform, branched. Stems 5–10 cm long, erect, simple, rarely branched, with few loosely scaly leaves; leaves ovate to broadly ovate, obtuse to acute, 1–3 mm long, 0.7–2 mm wide, appressed. Inflorescences loose racemose, 4–10 cm long, with 4–25 flowers; bracts minute, ovate to broadly ovate, obtuse to acute, 1–2 mm long, appressed to pedicel; pedicels filiform, 2–10 mm long, more or less recurved. Flowers protogynous, bisexual, sometimes with a few male flowers on upper part of raceme;

perianth connate at base, segments 3–6, triangular-ovate, ca. 1 mm long, reflexed, apex acute and bearded with few long hairs; stamens 3–6, opposite to perianth-segments; anthers (2–)3-celled; carpels about 20, oblong, 0.8 mm long at maturity; style attached slightly above base on ventral side of carpel, about half as long as the carpel; stigma clavate, with dense cylindrical papillae. Fruits globose, ca. 1.5 mm across; seeds dark brown, glossy.

Distribution: Japan: Kyushu (Kagoshima and Miyazaki Pref.) and Ryukyus (Iriomote-jima and Okinawa islands), Taiwan, China (Hainan), widely in Malesia and Sri Lanka.

Specimens examined. Japan. Kyushu. **Kagoshima** Pref., Mt. Takakuma-yama. 12 Sep. 1935. K. Hori (KYO–holotype of *S. takakumensis* Ohwi); loc. cit. 5 Oct. 1935. K. Hori (TI); Yoshino-mura. ?3 Oct. 1920. T. Awata (MAK 24946).

Ryukyus. **Okinawa** Pref. Okinawa island. Ogimison. 9 Jul. 1951. T. Amano 6574 (RYU), Oshikawa. Jul. 1999, fl. M. Yokota s.n. (RYU). Iriomote-jima island. Aira-gawa. 11 June 1987. D. Shimizu (TI).

Ohwi (1938) stated in the original description that *Sciaphila takakumensis* is similar to *S. tenella* Blume or *S. hermaphrodita* Schletr, but distinguished it from them in having four perianth-segments in the female flowers. Perianth-segments vary in number, often six and sometimes four. Plants referable to *S. takakumensis* Ohwi from Iriomote-jima island, D. Shimizu s.n. (TI), have six perianth-segments and three stamens. *Sciaphila takakumensis* was described as having no male flowers (Ohwi 1938), but Hatusima (1971) recorded that it has a few male flowers on upper part of inflorescences. These facts indicate that the diagnostic character of *Sciaphila takakumensis* from *S. tenella* or *S. hermaphrodita* is variable and continuous with the variation range of the latter two. All the characteristic features of the type of *S. takakumensis*, i.e., four perianth-segments, four stamens, short inflorescences (2–5 cm long) with lax flowers and a few bisexual flowers without male

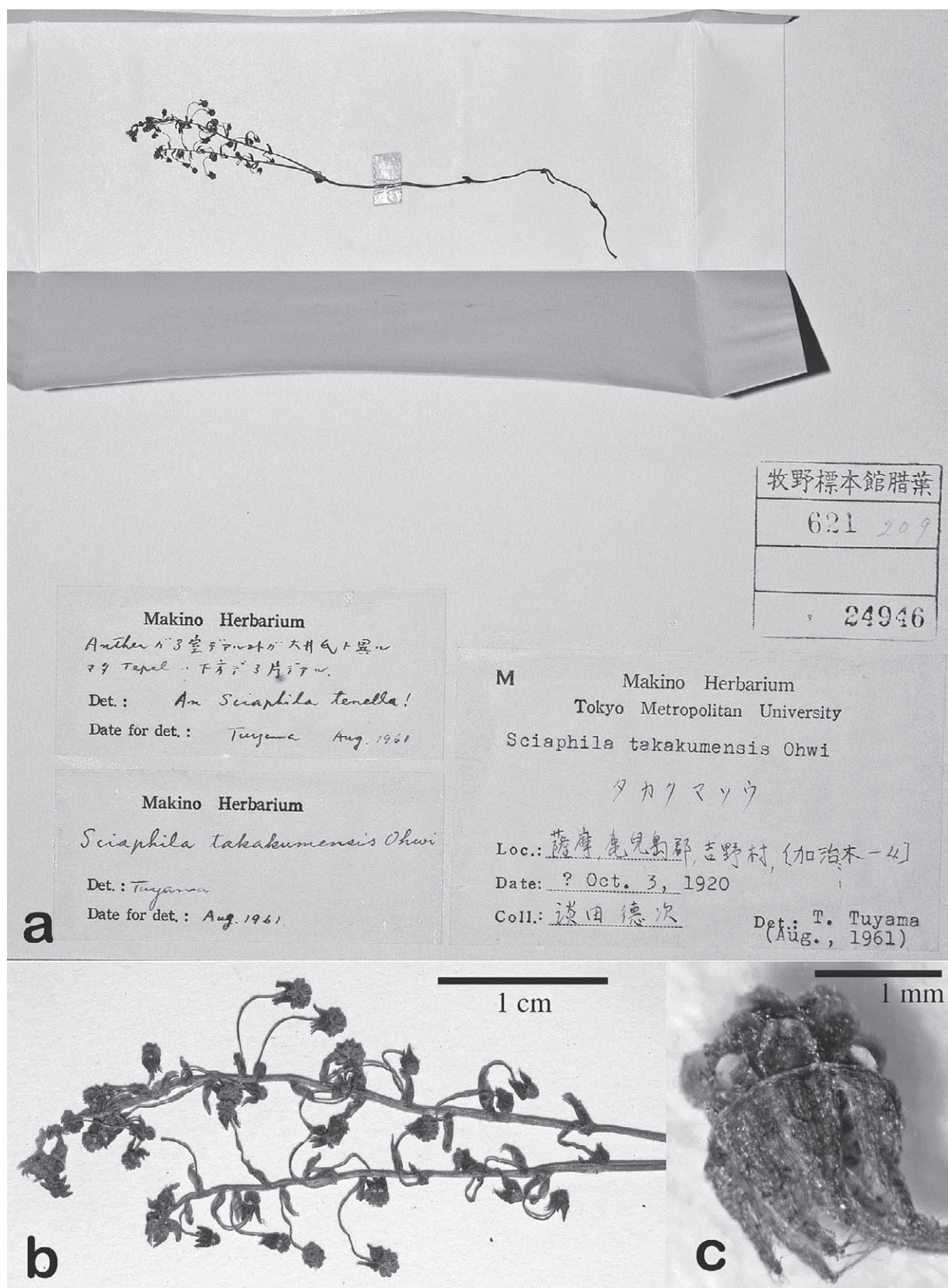


Fig. 7. a–b: *Sciaphila tenella* Blume in Kagoshima Pref., Yoshino-mura. Awata s.n. (MAK 24946). c: Flower showing bearded perianth segments. Ryukyus. Iriomote-jima island. Shimizu s.n. 11 June 1987 (TI).



flowers, and fewer carpels (ca. 20 ovaries), suggest the species was described probably based on poorly developed plants of the latter species (Fig. 7). The type locality of *S. takakumensis* is situated on the northernmost habitat within the range of *S. tenella* or *S. hermaphrodita*. Such poorly developed individuals as the type specimens of *S. takakumensis* are supposed to be found in lower temperature environment in comparison with habitats in tropical or subtropical regions.

*Sciaphila tenella* and *S. hermaphrodita* were treated by Meerendonk (1984) as members of subsect. *Polyandra* of sect. *Hermaphroditantha* which is characterized in having male and bisexual flowers. He regarded the latter species as identical with *S. maculata*. They are distinguished by the number of stamens; three in male and bisexual ones in *S. maculata*, while six in male and 3–6 in bisexual in *S. tenella*. We consider that *S. maculata* including *S. hermaphrodita* is indistinguishable from *S. tenella*. Hatusima (1971) suggested that *S. takakumensis* is close to *S. affinis* Becc., but the latter species was regarded by Meerendonk (1984) a synonym of *S. maculata*. Recently, *S. maculata* was found in Taiwan (T. H. Hsieh et al. 2003).

*Sciaphila takakumensis*, *S. hermaphrodita*, and *S. maculata* are, therefore, recognized as conspecific with *S. tenella*.

We thank KYO, MAK, RYU, TI and TUS for our examination of specimens in their care, and EAC Okinawa Co. for sending the plants found at Ishigaki-jima island that are referred *Sciaphila multiflora* in this work with clear photographs in their natural habit. Professor Y. Tateishi of Ryukyu University for examining specimens in RYU and Dr. T. Fukuda of Kyoto University for her help to examine the holotype of *Sciaphila takakumensis* Ohwi in KYO.

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のホンゴウソウ科

日本のホンゴウソウ科を再検討し、日本にイシガキソウ (新称) *Sciaphila multiflora* Giesen, ホンゴウソウ *S. nana* Blume (= *S. japonica* Makino), ウエマツソウ *S. secundiflora* Thwaites ex Benth. (= *S. tosaensis* Makino, *S. boninensis* Tuyama), タカクマソウ *S. tenella* Blume (= *S. takakumensis* Ohwi) およびスズフリホンゴウソウ *S. ramosa* Fukuy. & T. Suzuki (= *S. okabeana* Tuyama) の5種を認めた。

イシガキソウは日本新産である。雌雄異花で花序の途中に雄花がつき、その上下に雌花がつくという日本産他種に見られない特徴をもつ。

ホンゴウソウは日本特産種として宮城県松島から沖縄までに分布するとされていたが、ヴェトナム、タイ、マレーシア、スマトラ、ジャワ、フィリピンに知られている *S. nana* Blume と同種と考えられる。学名 *S. japonica* Makino のホロタイプは TI の標本で、MAK の標本はアイソタイプと選定した。

スズフリホンゴウソウは台湾固有とされるササキソウ *S. ramosa* Fukuy. & T. Sasaki と同種であると考えられる。ササキソウは本誌12巻6号(1936年6月)に発表され、スズフリホンゴウソウ *S. okabeana* Tuyama は植物学雑誌50巻通巻596号(1936年8月)に発表されたので、*S. ramosa* に優先権がある。和名はスズフリホンゴウソウを採りたい。なお、ササキソウは台湾のフロラ解明に大きな貢献をした佐々木舜一氏を記念して献名されたものである。

スズフリホンゴウソウは小笠原諸島父島でウエマツソウ (当時はムニンホンゴウソウ) に混じって発見された。平凡社版「寺崎日本植物図譜」(初版1977, 第2版1979とも同じ) 図3305ムニンホンゴウソウにもスズフリホンゴウソウと一緒に描かれている。同図には3個体が描かれているが、向かって右側の2個体と右上部の花序はスズフリホンゴウソウであり、同図向かって左側の1個体と図中央の雄花および雌花はウエマツソウ (= ムニンホンゴウソウ) である。この図に描かれた材

料は1937年6月に小笠原諸島で採集されたもので、恐らく一つの集団に両種が混生していたものと思われる。また、同図譜図3306スズフリホンゴウソウには3個体が描かれているが、これらは全てウエマツソウである。なお、著者の一人加藤の観察では父島と兄島の集団でもスズフリホンゴウソウとウエマツソウとは同所的に生育していた。

ウエマツソウとムニンホンゴウソウとは日本特産種とされていた。最近の調査ではムニンホンゴウソウは小笠原父島と兄島には非常に多く生育する。この2種は全くの同種であり、さらにスマトラ、マレーシア、ボルネオ、ニューギニア、タイ、香港などに広く分布する *S. secundiflora* Thwaites ex Benth. と同種であることが明らかにされている (Ohashi 2000)。本種の花柱は膨かな棍棒状であり、表面には乳頭突起が密生する。

Makino (1905) は *S. tosaensis* Makino の和名を “Uyematsu-sô, Tokihisa-sô (nov.)” と発表した。これは2つの名前であり、植松栄次郎と時久芳馬をそれぞれ記念したものである。その後ウエマツソウが通用している。この植物の最初の発見者は時久氏であったが、牧野博士は標本2点を植松氏から受け取った (牧野富太郎 1905。本郷草科の一新品。植物学雑誌 19: 224. 1905)。植松氏はホンゴウソウ発見者の一人でもある。

タカクマソウは日本特産種として鹿児島県から記載され、今日では宮崎県と沖縄県にも知られている。当初本種の特徴とされた花被裂片と雄蕊がそれぞれ4個である点は3–6個の間で変異する形質であり、他の形態的特徴と併せるとタカクマソウは *S. tenella* Blume と同種であると考えられる。本種はスリランカ、スマトラ、マレーシア、ボルネオ、スラウェシ、ジャワ、フィリピン、ニューギニア、ソロモン諸島などに広く分布する。

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